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(54) IMPROVEMENTS IN OR RELATING TO THE AUTOMATIC FEEDING OF WORKPIECES OF LIMP SHEET MATERIAL

(71) We, SAMCO-STRONG LIMITED, a British Company of Norfolk Works, Clay Hill, Bristol, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention is concerned with improvements in or relating to the auomatic feeding of workpieces of limp sheet material, more especially with work guidance mechanisms for guiding such workpieces as they are fed through an operating locality of a machine, and with apparatus suitable for use in operating along marginal edge portions of such workpieces.

There is hereinafter described in detail, to illustrate the invention by way of example, apparatus suitable for use in performing sewing operations along marginal edge portions of workpieces of limp sheet material, this illustrative apparatus comprising a conventional sewing machine having an operating locality at which needle supporting means is arranged to operate, the machine also comprising drive means for effecting reciprocating movement of the needle supporting means and intermittently operable workpiece feeding means for feeding workpieces along a path through said operating locality. In addition the illustrative apparatus comprises work guidance mechanism, illustrative of the invention in its work guidance mechanism aspects.

The illustrative work guidance mechanism is suitable for use in guiding workpieces of limp sheet material as they are fed through the machine operating locality and comprises a work table for supporting a workpiece to be operated upon and and edge guide member which is mounted on the work table and against which an edge of a workpiece supported by the work table can abut. The illustrative work guidance mechanism, also comprises a spreader plate arrangement, including a spreader plate having a workpiece spreading surface which co-operates with the work table whereby a workpiece can be maintained in outspread (i.e. unruffled) condition as it is fed as aforesaid and guided on the work table, said plate being movable towards and away from the work table into and out of an operative position in which the workpiece spreading surface thereof is spaced apart from the work table by approximately the thickness of a workpiece to be operated upon, the operative position being adjustable according to the thickness of such workpiece.

The illustrative work giudance mechanism also comprises workpiece orienting means for maintaining an edge of a workpiece, as it is fed, in abutting engagement with the edge guide member, which means comprises a workpiece orienting member in the form of an L-shaped finger by which a workpiece can be clampingly engaged against the work table and which is mounted for pivotal movement along an arcuate path, in clamping engagement with such workpiece, to cause said workpiece to be oriented to maintain its edge in abutting engagement with the edge guide member. The workpiece orienting means also comprises first fluid pressure operated means for moving the workpiece orienting member towards and away from the work table to clampingly engage and release a workpiece supported thereby, and second rack-and-pinion means, also operated by fluid pressure, for effecting pivotal movement of the workpiece orienting member, when in such clamping engagement, along its path to maintain the workpiece edge in abutting engagement with the edge guide member.

The workpiece orienting means is further operable, after a pre-set number of operations thereof has been effected, to withdraw a workpiece from the operating locality of the machine, such withdrawal being effected by causing the workpiece orienting member to move, while maintained in clamping engagement with such workpiece, in an opposite direction along said path.

The illustrative work guidance mechanism

also comprises air blast means for directing a blast of air onto a workpiece as it is guided by the workpiece orienting member thus to counter any tendency of such workpiece to buckle as it is so guided.

The spreader plate of the spreader plate arrangement of the illustrative work guidance mechanism is so shaped that the path of movement of the workpiece orienting member follows closely adjacent an edge of the spreader plate without, however, impeding the movement of the member. In addition the spreader plate is so shaped as to leave exposed a portion of the work table whereby, when a workpiece supported by the work table is being fed as aforesaid, a blast of air can be directed against a portion of such workpiece supported by the exposed portion of the work table.

For controlling its operation the illustrative work guidance mechanism comprises first sensing means, in the form of fluidic sensors, for sensing change in edge contour of a workpiece as it is being fed as aforesaid, the workpiece orienting means being operable in response to actuation of the sensing means, as a workpiece is being fed, so as to maintain an edge of such workpiece in abutting engagement with the edge guide member as aforesaid.

The illustrative work guidance mechanism also comprises further sensing means, also in the form of fluidic sensors, for sensing the approach of a workpiece edge towards the edge guide member, the air blast means being operable in response to actuation of said further sensing means so that as the edge of a workpiece approaches the edge guide member a blast of air can be directed thereonto thus to counter any tendency of the workpiece to buckle during its approach.

The illustrative work guidance mechanism further comprises another sensing means, again in the form of fluidic sensors, by which, as a workpiece is fed as aforesaid, the number of operations of the workpiece orienting means in guiding such workpiece is counted, the arrangement being such that, after a pre-set number of operations of the workpiece orienting means has been effected as aforesaid, the workpiece orienting member is caused to operate to withdraw the workpiece from the operating locality of the machine. Said other sensing means is also effective, after a preset number of operations has been counted as aforesaid, to cause the spreader plate to be raised out of its operative position, thus to avoid a workpiece marginal edge portion which has alreary been operated upon, e.g. folded over and stitched, being trapped as it moves between the workpiece spreading surface of the said plate and the work table.

The illustrative apparatus also comprises workpiece edge folding means by which a marginal edge portion of a workpiece being fed and guided as aforesaid can be folded over prior to arriving at the operating locality of the sewing machine. In addition the illustrative apparatus comprises a trimming knife for trimming the marginal edge portion of a workpiece being fed as aforesaid prior to the folding over operation, and also a thread severing device operable after a pre-set number of operations of the workpiece orienting means has been counted as aforesaid by said other sensing means, to cause the thread used for the sewing operation to be severed.

Conveniently in the operation of the illustrative apparatus a workpiece to be operated upon is placed on the work table with a "starting" end of a straight side thereof at the operating locality of the machine and with a portion of the workpiece edge in abutting engagement with the edge guide member in such a manner that the fluidic sensors of the first sensing means are interrupted, so that a cycle of operation of the illustrative apparatus is initiated. The workpiece is thus fed by the workpiece feeding means and its marginal edge portion passes through the operating locality of the machine, said edge portion being thus progressively folded over and stitched. As a convex corner approaches the operating locality the fluidic sensors of the first sensing means are uncovered and thus actuated and cause the workpiece orienting means to operate whereupon the workpiece orienting member is first moved to clampingly engage the workpiece against the work table and is then moved from an initial position along its path, while in such clamping engagement whereby to maintain the edge of the workpiece in abutting engagement with the edge guide member. The arrangement of the illustrative apparatus is such that when the workpiece has been thus re-oriented, a portion thereof again interupts the fluidic sensors of the first sensing means, whereupon said first sensing means is de-actuated and the workpiece orienting member is thus moved out of clamping engagement with the workpiece and is returned to its initial position. During such guidance of a workpiece, as the edge thereof approaches the edge guide member, the further sensing means is actuated as aforesaid and causes the air blast means to be operated whereby to counter any tendency of the workpiece to buckle as it is so guided.

In the last of the pre-set number of the workpiece orienting means, after said means has been actuated to cause the member thereof clampingly to engage the workpiece and to move along its path as aforesaid, interruption of the fluidic sensors of the first sensing means by the re-oriented workpiece is not effective in this case to cause the member to move out of clamping engagement with the workpiece, but rather said member is retained in such engagement while it is returned to its

initial position. In this way the workpiece is withdrawn from the operating locality of the machine.

Also when the last of the pre-set number of operations of the workpiece orienting means has been counted as aforesaid, the spreader plate is raised to allow the already folded over and stitched portion of the workpiece to be accommodated and also the thread severing device is caused to operate. The cycle of operation of the illustrative apparatus is thus terminated.

Using the illustrative apparatus it will be apparent that marginal edge portions of workpieces of limp sheet material can be folded over and stitched automatically, under the control of the illustrative work guidance mechanism, which also is effective to minimise the risk of the limp material becoming ruffled during the feeding and guiding thereof. Furthermore the construction and arrangement of the illustrative apparatus is relatively simple and inexpensive.

The invention provides work guidance mechanism for guiding workpieces of limp sheet material as they are fed through an operating locality of a machine, said mechanism comprising a work table for supporting a workpiece to be operated upon, an edge guide member against which an edge of a workpiece supported by the work table can abut, sensing means for sensing change in edge contour of a workpiece as it is being fed as aforesaid, workpiece orienting means, operable in response to actuation of the sensing means, when a workpiece is being fed, for maintaining an edge of such workpiece in abutting engagement with the edge guide member, and a spreader plate arrangement having a workpiece spreading surface which co-operates with the work table whereby a workpiece can be maintained in outspread condition as it is fed and guided as aforesaid, the workpiece orienting means comprising a member for clampingly engaging a workpiece against the work table, first means for moving said member towards and away from the work table to clampingly engage and release a workpiece supported thereby, and second means for effecting movement of said member, when in such clamping engagement, along a path to maintain the workpiece edge in abutting engagement with the edge guide member.

The invention also provides apparatus suitable for use in operating along marginal edge portions of workpieces of limp sheet material comprising a machine having an operating locality and workpiece feeding means for feeding workpieces through said locality, in combination with a work guidance mechanism as set out in the last preceding paragraph.

The invention further provides apparatus suitable for use in performing sewing operations along marginal edge portions of workpieces of limp sheet material comprising needle supporting means arranged to operate at an operating locality, drive means for effecting reciprocating movement of the needle supporting means, a work table by which a workpiece to be operated upon can be supported, workpiece feeding means for feeding a workpiece along a path through said operating locality, an edge guide member against which an edge of a workpiece being fed as aforesaid can abut, sensing means located "upstream" of the operating locality in the feed path of a workpiece for sensing change in edge contour of a workpiece as it is fed by the workpiece feeding means, workpiece orienting means, operable in response to actuation of the sensing means, for maintaining an edge of such workpiece in abutting relationship with the edge guide member, and a spreader plate arrangement having a workpiece spreading surface which co-operates with the work table whereby a workpiece can be maintained in outspread condition as it is fed and guided as aforesaid, the workpiece orienting means comprising a member for clampingly engaging a workpiece against the worktable, first means for moving said member towards and away from the work table to clampingly engage and release a workpiece supported thereby, and second means for effecting movement of said member, when in such clamping engagement, along a path to maintain the workpiece edge in abutting engagement with the edge guide member.

There now follows a detailed description to be read with reference to the accompanying drawings, of the illustrative work guidance mechanism and illustrative apparatus. It will of course be realised that this illustrative work guidance mechanism and this illustrative apparatus have been selected for description merely by way of exemplification of the invention and not by way of limitation thereof.

In the accompanying drawings:—

Figure 1 is a perspective view, from the front, of the illustrative apparatus, showing the illustrative work guidance mechanism thereof, and with other parts indicated by dash-lines in the background;

Figure 2 is an end view, largely in vertical section, showing a spreader plate arrangement and other instrumentalities of the illustrative work guidance mechanism as seen in inoperative condition;

Figure 3 is a view corresponding to Figure 2 but illustrating the various instrumentalities in operative condition;

Figure 4 is a section taken on the line IV—IV of Figure 3;

Figure 5 is a fragmentary plan view showing sensing means of the illustrative work guidance mechanism; and

Figure 6 is a schematic diagram of a fluidic control circuit of the illustrative apparatus.

The illustrative apparatus comprises a

machine suitable for use in "hemming" or "overedging" (that is folding over and stitching) workpieces of limp sheet material, e.g. fabric pieces of generally rectangular shape such as face cloths. The machine thus comprises a fixedly mounted throat plate 12 (Figures 1 and 4) which overlies a rectilinear feeding feed dog mechanism 13 (shown only in Figure 5), constituting workpiece feeding means, for incrementally advancing a workpiece W to the left, viewing Figures 4 and 5, and parallel to a straight stop cover 14. The plate 12 defines an operating locality constituted by a needle operating zone Z (Figures 4 and 5) adjacent to workpiece edge folding means provided by a stationary narrow folder 16 of conventional form. As shown in Figure 5, the illustrative machine is also provided with a trimming knife 17 for rounding angular corners, severing irregular marginal edges and threads ahead of the folder 16, a vacuum duct 18 (Figure 1 and 2) being arranged below the knife to dispose of trimmed off material.

In order to enable the illustrative apparatus to operate continuously and automatically along straight marginal edge portions and inter-connecting curved marginal edge portions of a workpiece, e.g. margins comprising four corners C (on shown trimmed and sewn in Figure 5) commonly found in face cloths or other rectangular articles having "corners" of predetermined radius, the apparatus also comprises work guidance mechanism, illustrative of the invention in its work guidance mechanism aspects, this illustrative mechanism comprising a stationary work table 20 (Figures 1, 4 and 5) mounted co-planar with the plate 12, the table being formed with a convex, substantially circular, outer edge 22 which extends inwardly toward an edge guide member 24 (Figures 3 to 5) fixed on the table 20. The table is supported on a frame including an overhanging U-shaped plate 26 (Figures 1 to 3).

The illustrative work guidance mechanism also comprises a spreader plate arrangement including a spreader plate 30, of low-friction transparent plastics material, having a convex edge 32 (Figures 1 and 4) of contour similar to that of the edge 22 of the work table, though of smaller radius, the plate having a workpiece spreading surface which co-operates with the work table whereby a workpiece can be maintained in outspread (i.e. unruffled) condition as it is fed as aforesaid. The plate 30 is yieldingly spaced parallel to the table 20 by means of a pair of leaf springs 34, 36 (Figures2 and 3) interconnecting upright brackets 38, 40, the former of which is connected to the plate 30 and the latter to the U-shaped plate 26. The arrangement is such that the springs 34, 36 normally lift the plate 30 sufficiently (see Figure 2) to allow easy admission and removal of a workpiece W to be processed, an upper, out-of-the-way, position of the plate 30 being adjustably determined by a stop screw 42 threaded through a bracket 44 for engagement with the spring 34. A lower, operative, position of the plate 30, only slightly above the upper face of the workpiece, is adjustable for different thicknesses of workpiece by means of a stop screw 46 engageable with the under-side of the spring 36, the screw being threaded through a bracket 48 secured to the bracket 40.

For shifting the plate 30 downwardly to its operative (work spreading) position, fluid pressure is admitted to a cylinder 50 (Figures 1 to 3) supported from the frame plate 26, and carrying a spring return piston rod 52. A threadedly adjustable head 54 on the rod 52 is arranged to engage the bracket 38 and move it downwardly from its upper position shown in Figure 2 to its lower position shown in Figure 3, upon commencement of a sewing operation in response to presentation of a workpiece, as will be hereinafter described.

The spreader plate 30 has a cut-away portion 55 (Figures 1 to 5) for accommodating various sensing means of the illustrative work guidance mechanism, said means comprising three pairs of fluidic sensors designated 56, 58; 60 and 62; and 64, 66 forming part of a control circuit (Figure 6). In order to be responsive and properly sensitive to fabric of different mesh or porosity, sensors 56, 58 are respectively provided with small, medium, and large size orifices generally designated 68 (Figure 5), a pair of like sizes being in communication unless fluid flow therebetween is interrupted, e.g. by the presence of a workpiece W in edge contact with the guide member 24 or approaching such contact. The orifices 68 are arranged so that they are larger in the communicating pairs nearer the guide member 24. The arrangement is such that, as the marginal edge portion of the workpiece is progressively folded over and fed leftward (viewing Figure 5) relative to the needle operating zone Z, a change in edge contour of the workpiece is effective to discontinue interruption of air flow between the sensors 56, 58, as indicated in dashed line in Figure 5, whereupon workpiece orienting means, including a member in the form of an L-shaped work-engaging finger 70 (Figures 1 to 4), is automatically actuated as hereinafter described to swing the work counterclockwise (viewing Figures 4 and 5) and thereby re-position it so as to re-interrupt the air flow and maintain substantially uniform overedging without interruption or slow down of the operation.

The finger 70 of the workpiece orienting means carries a tubular rubber work-engaging tip 72 and, in response to the sensors 56, 58, is movable both heightwise to clampingly engage a workpiece against the work

table and also along an arcuate path while in such clamping engagement (the spreader plate 30 being so shaped that the arcuate path of finger 70 follows closely adjacent the edge 32 thereof), first means being provided for effecting heightwise movement of the finger as aforesaid and second means for effecting movement thereof along an arcuate path. One end of the finger 70 is formed as a collar 74 (Figures 1, 2 and 3) secured to the lower end of a shaft 76 (see also Figure 4), which is mounted for rotation about a vertical axis and extends through aligned bores formed on horizontal arms of a U-shaped bracket 78. When the illustrative apparatus is in use, the location of the axis of the shaft 76, i.e. the pivot point of the tip 72, is determined by the radius of the corner to be negotiated in conjunction with the speed of rotation of the shaft. For example, for a minimum corner radius of about 2", the axis is located empirically 1-3/4" out from and in line with the front edge of the trimming knife 17. The bracket 78 is secured to a bracket 80 itself rigidly supported by an S-shaped support 81 secured to the plate 26. The second means is effective to cause rotation of the shaft 76, said means comprising an air cylinder 82 (Figures 1 and 4) having a horizontal piston rod 84 which shifts a rack 85 for rotating a pinion 86 secured on the shaft 76. The first means comprises a compression spring 88 (Figures 1, 2 and 3) which acts between a collar 90 on the shaft 76 and a flange of the bracket 78 and yieldingly urges the finger tip 72 downwardly into its operative work-engaging condition, while the rack and pinion remain in mesh, said means also comprising, for overcoming the spring 88 and raising the finger 70, a swivel support 92 from which the shaft 76 is suspended by means of a collar 94 and which is urged upwardly by a tension spring 96 interconnecting the support 92 and an air cylinder 98 mounted on the bracket 80. The spring 96, in turn, is overcome at proper times by operation of fluid pressure admitted to the cylinder 98 to cause its piston rod 100, threadedly connected to the support 92, to project the shaft 76 downwardly. Thus, in response to non-interruption of the air flow between the sensors 56, 58 by a workpiece, the tip 72 is at once lowered to engage the workpiece approximately in the full line position indicated in Figure 4 and then to be swung from such initial position counterclockwise about the axis of the shaft 76 to about the dashed line position shown. With the air flow then cut off between the sensors 56, 58, the tip 72 is raised out of engagement with the workpiece and is returned about its axis to its intial position (except in the case of the final "corner" of the workpiece, as will be hereinafter described). The edge of the workpiece W to be overedged is thus swung to maintain operative relation with the folder 16 and again abuts the edge guide member 24 as shown in Figure 5.

It is to be noted that other forces are also simultaneously tending to aid in restoring the workpiece edge to be overedged into contact with the guide member 24. As the feed dog mechanism repeatedly exerts feeding movements tending also to swing a workpiece W to be overedged counterclockwise, a portion of the workpiece overhangs the convex outer edge 22 of the table 20 and tends to slide circumferentially thereby shifting the horizontally supported portion of the workpiece toward the edge guide member independently of any urging of the finger tip 72. The width of the table 20 should be appropriate for the nature of the workpiece and not provide excessive drag tending to misalign the workpiece with the guide member 24.

The sensors 60, 62 are provided for counting the number of operations of the workpiece orienting means in guiding a workpiece, as it is fed through the operating locality as aforesaid, in response to non-interruption of said sensors. In overedging a conventional rectangular towel, for example, when the final, fourth, corner C thereof (see Figure 5) has been negotiated, the control circuitry responsive to the sensors 60, 62 stops operation of the feed dog mechanism of the sewing machine and also automatically actuate a thread severing device provided by a cutter 102 (Figures 1 to 4) controlled by fluid pressure admitted to a cylinder 104. This cylinder is supported from a bracket 106 depending from the plate 26 and has a piston rod 108 operatively connected to the cutter 102. The control circuitry may be adjusted to actuate the cutter and stop the operation of the feed dog mechanism after any selected number of operations of the workpiece orienting means has been effected.

The sensors 60, 62 also serve another important purpose. When the final corner of a workpiece has been overedged, they act automatically to exhaust the cylinder 50 thereby allowing the spreader plate 30 to be spring-lifted sufficiently to enable the additional thickness of the seam of the intial overedging to pass thereunder.

The full perimeter of the workpiece W may then be procesed and the overedging overlapped adjacent to the final corner as desired. Also, when the pre-set number of operations has been counted as aforesaid, the finger tip 72 remains down in clamping engagement with the workpiece as the finger 70 is rotatively retracted so that the material of the workpiece about to engage the trimming knife and presser foot is removed from the needle operating zone Z.

In order to militate against the forces which act on a workpiece to urge it against the edge guide member 24 causing the workpiece edge

to buckle, jam or unduly furl, the sensors 64, 66 are disposed immediately adjacent to the edge guide member 24 in position to be interrupted just prior to the workpiece edge abutting against the guide member. Accordings at initial fluid flow cut-off between the smallest orifices 68 of the sensors 64, 66 as the workpiece approaches the guide member, a small checking effect in this approach is caused by directing an air blast via a nozzle 110 (Figures 1, 3 and 4) against the workpiece and away from the edge guide member 24. As the larger pair of orifices 68 of the sensors 64, 66 is interrupted, further air checking is similarly obtained and the workpiece edge is thus enabled gently to be maintained in proper contact with the edge guide member. The signal from the sensors 64, 66 activates the air blast which is found to counter any tendency of the workpiece to buckle when operating in conditions up to 80% relative humidity and 90° F temperature.

A sequence of operations of the illustrative apparatus will now be briefly described with reference to Figure 6. A rectangular work towel W is placed on the table 20 under the plate 30 and with a "starting" portion of a first straight side in the needle operating zone Z. Presentation of the workpiece W with its straight trailing edge in contact (or near contact) with the edge guide member 24 interrupts the fluidic sensors 56, 58 and 60, 62, shifting Schmitt triggers 3—9 and 2—8 respectively associated therewith whereby signals are applied to fluidic device 4—10 and also to fluidic device 15. At the same time, a signal from 2—8 to fluidic device F16 is removed. The work presentation also interupts the sensor 64, 66 shifting its Schmitt trigger 1-7 and causing signals to be applied to valves V-7 and V-9. The valve V-7 supplies air flow to the nozzle 110.

With the illustrative apparatus now ready for operating, a presser foot 112 (Figures 1 and 5) and the spreader plate 30 are lowered automatically following closure of starting switch 114 (Figure 6) and consequent switching of fluid device F17, which operates through device F18 to switch valve V-1 to operate cylinder 50, through fluidic device 13-19 and its negating influence on devices F21 and F22, to switch valve V-4, and through fluidic device F23 to supply signals to fluidic devices 4-10, 5-11 and 6-12 forming part of the counting means of the illustrative mechanism. Switching valve V-4 causes air pressure to be supplied to switch PS-1, to valve V-3 which operates cylinder 118 to lower the presser foot 112, and to a clutch operating cylinder 116, by which clutch (not shown) the feed dog mechanism is actuated. Actuation of switch PS-1 is also effective to draw suction via the duct 18.

As a first corner C along the edge of the workpiece W approaches the operating locality, the air flow to the sensors ceases to be interrupted, thus switching 3-9, 2-8 and 1-7 to their initial condition. Switching 2-8 reverses devices F15 and F16, applying signals both to valve V-6, pressurising cylinder 98 to lower the finger tip 72 into its operative position, and to valve V-5, operating through a delay to pressurise the cylinder 82 to cause the finger 70 to rotate counterclockwise thereby turning the workpiece W so that a corner C is overedged; at the same time, switching 3-9 causes the first corner operation to be registered by the counting means. The earlier mentioned steps are now repeated for further rectilinear overedging. The illustrative machine at no time necessarily slows or stops as the corner is formed and sewn. As the next straight edge portion of the workpiece interrupts the sensors 56, 58 and 60, 62 and contacts the edge guide member 24 the signal is removed from the valves V-6, V-5, which operate in sequence to cause the turning tip 72 to be lifted from the work and returned angularly to its starting position in readiness for the next work corner. The machine does not stop but continues sewing the next straight edge.

Any tendency of the workpiece edge to swing hard against the edge guide member 24 and thus buckle, as the straight or nearly straight edge is urged towards the edge guide member 24, and as air flow between the sensors 64, 66 is interrupted, is countered by the action of an air blast from the nozzle 110 as above described, said blast tending to urge the fabric from interrupting relation with the sensor 64, 66. This checking air blast is turned on and off as the workpiece margin is progressively guided relative to the guide member 24 and to the needle operating zone Z.

The second and third corners C having also been registered in the fluidic counting means, as the fourth corner C is sensed by the sensors, not only does the workpiece orienting means function initially as in the case of previous carrier operations, but also a signal from the counting means to fluidic device F18 causes the valve V-1 to shift and exhausts the cylinder 50 thus allowing raising of the spreader plate 30 by the return spring of that cylinder and accommodating the thicker previously folded and sewn work edge. At the same time, a signal applied from F18 to F14 throughout the operating cycle is removed so that, with the signals to F14 from 3-9 and 2-8 also removed as the corner operation is completed and the sensors are again interrupted, fluidic device 13-19 signals devices F15 and F16 operates whereby the valve V-5 is shifted causing the turning tip 72, while still in clamping engagement with the workpiece, to return clockwise along its path from its dashed to solid line position shown in Figure 4. Hence the workpiece W

is steered away from and thus withdrawn clear of the edge guide member 24, the presser foot 112, and the trimming knife 17. At the same time, 13-19 applies a signal to F21 (effecting a time delay to determine the timing of the end of the operation) to apply a signal to device F22. Also, on expiration of the time delay, a signal via fluidic device F16 call for shifting of the valve V-6 whereby the returned tip 72 is lifted from the workpiece. The speed of angular retraction of the tip 72 taken with the degree of the time delay determines the accuracy of the final stitching in blending with the initial overedging. The signal applied to F22 in turn signals fluidic device F20 whereupon the valve V-4 shifts to remove air pressure from PS-1 stopping suction in the duct 18, from the clutch operating cylinder 116 to de-actuate the feed dog mechanism, and from the valve V-3 to raise the presser foot 112 by exhausting its operating cylinder 118 (Figure 6). A signal to PV-1, initiated by the time delay associated with fluidic device F20, causes the valve V-2 to effect one operating cycle of cylinder 108 to cause the cutter 102 to sever the thread chain automatically and allow removal of the work from the machine. (Actuation of a manually operable valve V-8 will also cycle the thread cutter 102 when desired). Actuation of a "stop" valve acting directly on 13-19 is effective to render inoperative the illustrative work guidance mechanism; actuation of treadle-operated valve V-10 overrides any signal via valve V-4 to PS-1, cylinder 116 and valve V-3, thus over-riding the control of termination of the operating cycle through device F18, as above described.

By reason of its reliable automatic workpiece orienting and work guidance as above described, a single operator may attend three apparatuses of the illustrative type, for instance, thereby continuously accomplishing at high linear feed speed, a high edge finishing output. Moreover, the system described permits processing any selected number of workpiece sizes, no adjustment being required for operating on different sizes of workpieces.

WHAT WE CLAIM IS:—

1. Work guidance mechanism for guiding workpieces of limp sheet material as they are fed through an operating locality of a machine, said mechanism comprising a work table for supporting a workpiece to be operated upon, an edge guide member against which an edge of a workpiece supported by the worktable can abut, sensing means for sensing change in edge contour of a workpiece as it is being fed as aforesaid, workpiece orienting means, operable in response to actuation of the sensing means, when a workpiece is being fed, for maintaining an edge of such workpiece in abutting engagement with the edge guide member, and a spreader plate arrangement having a workpiece spreading surface which co-operates with the work table whereby a workpiece can be maintained in outspread condition as it is fed and guided as aforesaid, the workpiece orienting means comprising a member for clampingly engaging a workpiece against the work table, first means for moving said member towards and away from the work table to clampingly engage and release a workpiece supported thereby, and second means for effecting movement of said member, when in such clamping engagement, along a path to maintain the workpiece edge in abutting engagement with the edge guide member.

2. Work guidance mechanism according to Claim 1 wherein the spreader plate arrangement comprises a spreader plate movable towards and away from the work table into and out of an operative position in which the workpiece spreading surface provided by the spreader plate is placed apart from the worktable by approximately the thickness of a workpiece to be operated upon.

3. Work guidance mechanism according to Claim 2 wherein the spreader plate is so shaped that the path along which the member of the workpiece orienting means moves as aforesaid to maintain the edge of a workpiece in abutting engagement with the edge guide member follows closely adjacent an edge of the spreader plate.

4. Workpiece guidance mechanism according to any one of the preceding claims wherein the member of the workpiece orienting means is mounted for pivotal movement about an axis, its path thus being arcuate.

5. Workpiece guidance mechanism according to any one of the preceding claims comprising another sensing means by which, as a workpiece is fed as aforesaid, the number of operations of the workpiece orienting means in guiding such workpiece is counted, said sensing means being effective, after a pre-set number of such operations has been counted, to cause the member of the workpiece orienting means to operate to withdraw such workpiece from the operating locality at which it has been operated upon.

6. Work guidance mechanism according to Claim 5 wherein, after a pre-set number of operations of the workpiece orienting means has been effected on a workpiece, as it is fed as aforesaid, the member of said means is caused to move, while in clamping engagement with such workpiece, in an opposite direction along its path and thus to withdraw such workpiece from the operating locality at which it has been operated upon.

7. Work guidance mechanism according to any one of the preceding claims wherein, in an operation of the workpiece orienting means, the member is first moved to clampingly engage a workpiece as aforesaid and is then

moved from an initial position along its path, while in such clamping engagement, whereby to maintain the edge of the workpiece in abutting engagement with the edge guide member, the arrangement being such that, once the workpiece edge is in such abutting engagement, the member is moved out of such clamping engagement and is then returned to its initial position, but further wherein, in the last of a pre-set number of such operations on a workpiece, as such workpiece is fed as aforesaid, the member is retained in such clamping engagement while it is returned to its initial position, thus to withdraw such workpiece from the operating locality at which it has been operated upon.

8. Work guidance mechanism according to either one of Claims 5 and 6 when appendant either directly or indirectly to Claim 2 wherein said other sensing means is also effective, when a pre-set number of operations of the workpiece orienting means has been counted as aforesaid, to cause the spreader plate arrangement to move out of its operative position.

9. Work guidance mechanism according to any one of the preceding claims comprising further sensing means for sensing the approach of a workpiece edge towards the edge guide member, and air blast means, operable in response to actuation of such further sensing means, for directing a blast of air onto a workpiece, as it is guided by the member of the workpiece orienting means as aforesaid, thus to counter any tendency of such workpiece to buckle as it is so guided.

10. Work guidance mechanism according to Claim 2 or to any one of Claims 3 to 8 when appendant directly or indirectly to Claim 2 comprising air blast means for directing a blast of air on to a workpiece, as it is guided by the member of the workpiece orienting means as aforesaid, thus to counter any tendency of such workpiece to buckle as it is so guided, the spreader plate being so shaped as to leave exposed a portion of the work table whereby, when a workpiece supported by the work table is being fed as aforesaid, a blast of air can be directed against a portion of such workpiece supported by such exposed portion of the work table.

11. Work guidance mechanism constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawing.

12. Apparatus suitable for use in operating along marginal edge portions of workpieces of limp sheet material comprising a machine having an operating locality and workpiece feeding means for feeding workpieces through said locality, in combination with a work guidance mechanism according to any one of the preceding claims.

13. Apparatus suitable for use in performing sewing operations along marginal edge portions of workpieces of limp sheet material comprising needle supporting means arranged to operate at an operating locality, drive means for effecting reciprocating movement of the needle supporting means, a worktable by which a workpiece to be operated upon can be supported, workpiece feeding means for feeding a workpiece along a path through said operating locality, an edge guide member against which an edge of a workpiece being fed as aforesaid can abut, sensing means located "upstream" of the operating locality in the feed path of a workpiece for sensing change in edge contour of a workpiece as it is fed by the workpiece feeding means, workpiece orienting means operable in response to actuation of the sensing means, for maintaining an edge of such workpiece in abutting relationship with the edge guide member, and a spreader plate arrangement having a workpiece spreading surface which cooperates with the work table whereby a workpiece can be maintained in outspread condition as it is fed and guided as aforesaid, the workpiece orienting means comprising a member for clampingly engaging a workpiece against the work table, first means for moving said member towards and away from the work table to clampingly engage and release a workpiece supported thereby, and second means for effecting movement of said member, when in such clamping engagement, along a path to maintain the workpiece edge in abutting engagement with the edge guide member.

14. Apparatus according to Claim 13 comprising also workpiece edge folding means by which a marginal edge portion of a workpiece being fed as aforesaid can be folded over prior to ariving at the operating locality.

15. Apparatus according to either one of Claims 13 and 14 comprising a trimming knife for trimming the marginal edge portion of a workpiece being fed as aforesaid prior to said edge portion being operated upon.

16. Apparatus according to any one of Claims 13 to 15 comprising a thread severing device and another sensing means by which, as a workpiece is fed as aforesaid, the number of operations of the workpiece orienting means in guiding such workpiece is counted, said sensing means being effective, after a preset number of such operations has been counted, to cause the said severing device to be

actuated to cause the thread used for the sewing operation to be severed.

17. Apparatus suitable for use in performing sewing operations on workpieces of limp sheet material, said apparatus being constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

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5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig. 1

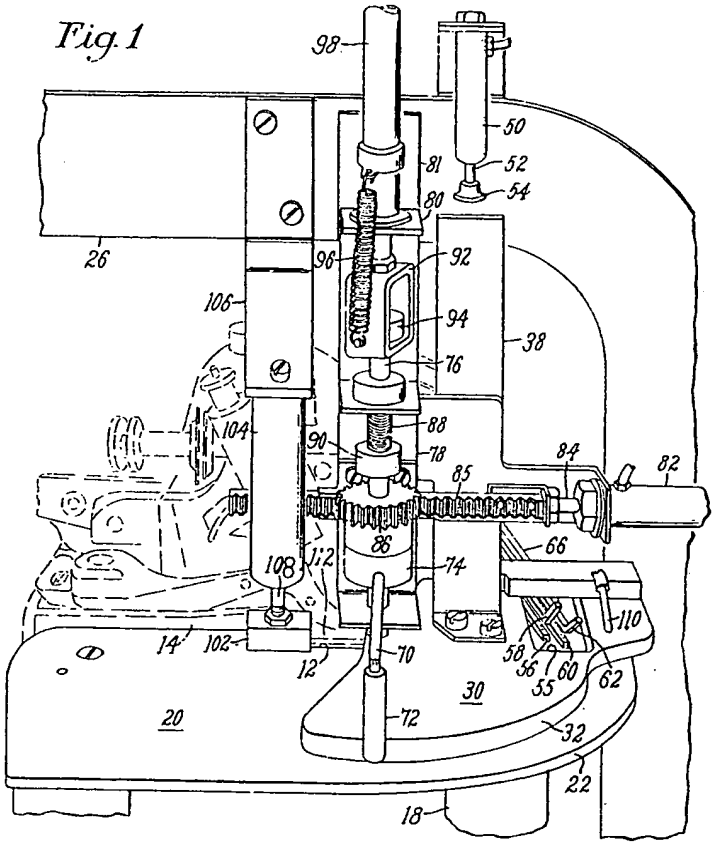

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Fig. 2

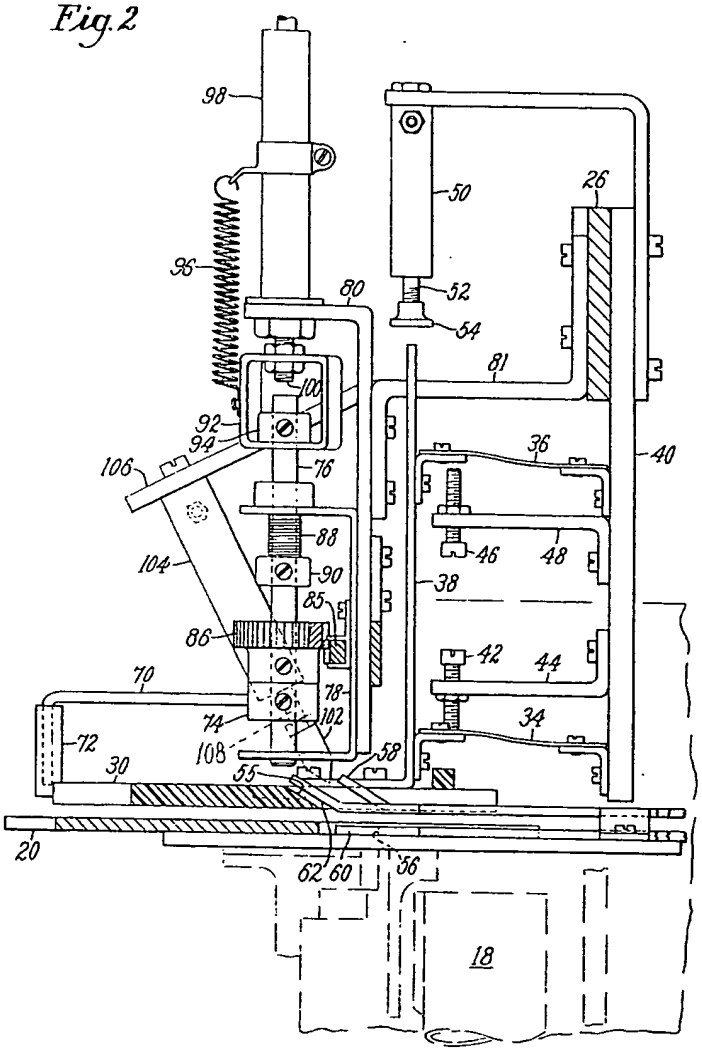

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Fig. 3

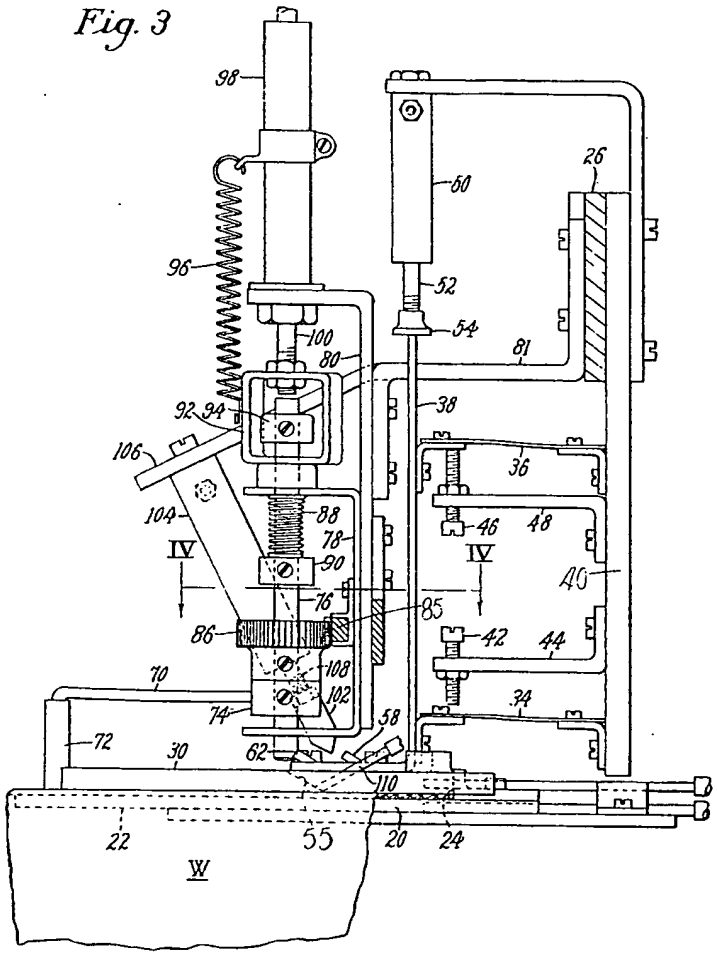

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Fig. 4

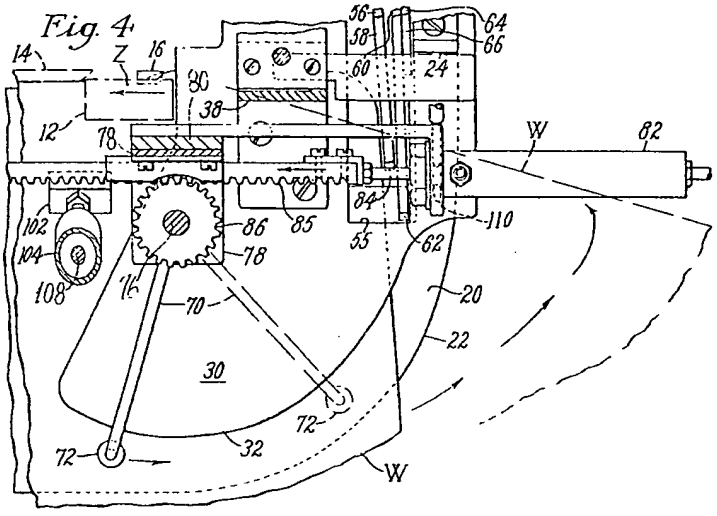
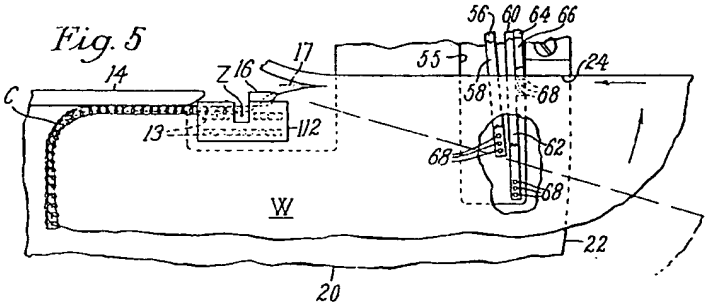


Fig. 5



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Sheet 5

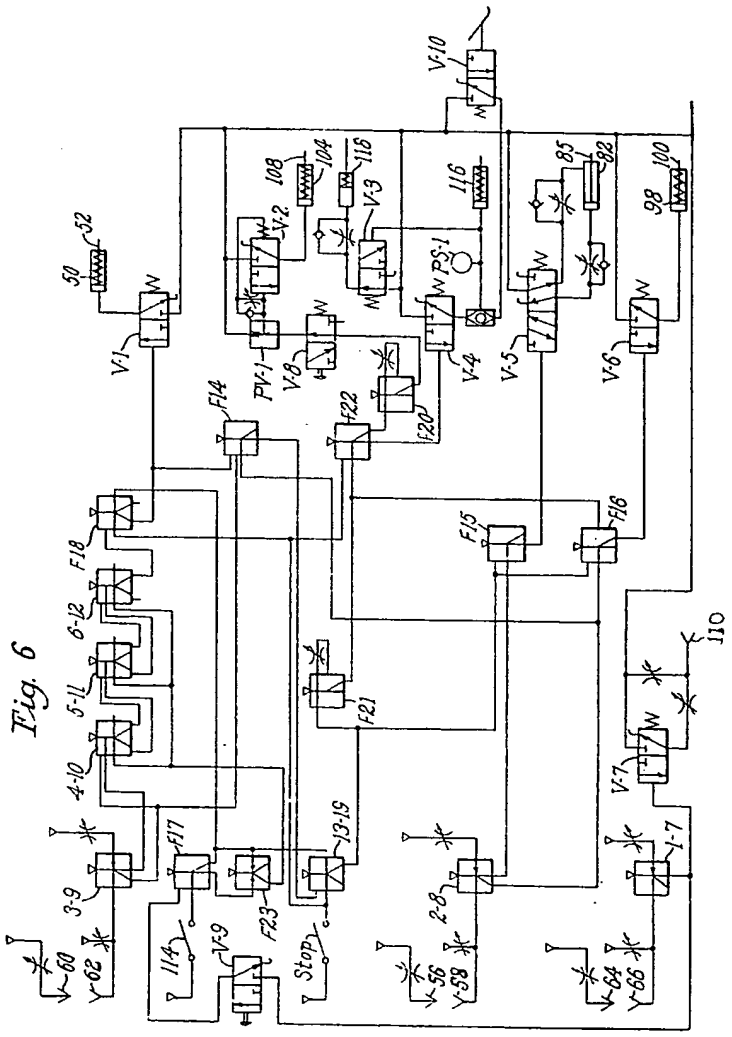

Fig. 6